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YUKON RIVER FALL CHUM TAGGING STUDIES AT GALENA

1976

(From Yukon River Anadromous Fish Investigations)
Completion Report for July 1, 1974 to June 30, 1977

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FALL TAGGING AT GALENA

Introduction

Fall chums are a unique race characterized by their large size, silvery appearance, late runs, and spawning only in areas of spring water. The commercial fall chum salmon fishery has expanded from an insignificant harvest in 1961 to a record catch of more than 276,168 fish in 1974 (Table 16). Since 1969 when this fishery began rapid expansion, the commercial harvest has averaged 228,985. The greatest harvest (commercial plus subsistence) was 348,944 in 1974.

Table 16. Yukon River fall chum salmon subsistence and commercial catches, 1961-1976 1/

Year	Subsistence	Commercial	Total
1961	107,572	45,739	153,311
1962	82,620	54,052	136,672
1963	124,519	2,192	126,711
1964	124,543	10,276	135,819
1965	122,015	25,388	147,403
1966	61,897	74,202	136,099
1967	82,344	41,617	123,961
1968	56,356	53,360	109,716
1969	58,193	152,018	210,211
1970	57,582	243,591	301,173
1971	64,383	248,145	312,528
1972	41,276	209,897	251,173
1973	46,544	267,127	313,671
1974	72,776	276,168	348,944
1975	69,732	267,656	337,388
1976	55,321	167,282	222,603

1/ Includes Yukon Territory catches.

Yukon River fall chums are fished intensively throughout the main River, especially at the mouth where the largest concentrations of gear is located. The commercial fishery is essentially similar to a "cape fishery", i.e., various stocks of fall chums are harvested indiscriminately several hundred miles and often several weeks before reaching spawning tributaries. It is unknown at this time whether spatial and temporal stock separation occurs as the stocks enter the commercial fishery.

Prior to 1974 there was very little information available on fall chums in the Alaskan portion of the Yukon River with regard to the magnitude of the run, numbers of salmon needed for adequate escapement, or spawning locations. Through extensive aerial surveys conducted in recent years the major spawning areas have not been identified and information is accruing on escapements. Table 2 lists major fall chum systems with escapements for 1974 through 1976 (see also Appendix Table 5).

The Department has taken a conservative approach toward managing the Yukon River fall chum salmon fishery until further knowledge of stock numbers, spawning areas, and optimum harvest rates becomes available. A 250,000 maximum harvest limit has been established by the Board of Fish and Game until returns from current levels of harvest can be evaluated. Quotas of 200,000 for the lower Yukon and 50,000 for upper Yukon have been set for fall chum and coho salmon combined. The 1975 commercial harvest was curtailed when it approached the 250,000 level. An apparent weak run of fall fish in 1976 was protected by fishing time reductions and complete closure of subdistrict 5; a total commercial harvest of 167,282 fall chums resulted.

Chum moving into the lower Yukon River after July 15 are predominantly fall fish. Fall chum salmon runs in the lower River are characterized by extreme fluctuation in abundance as they enter the River. Fluctuations in abundance may represent discrete stocks.

If the timing or origin of these stocks could be distinguished, prior to, or during the fishery then the management program could be modified to allow for a more equitable harvest of the various stocks in relation to their relative abundance. For example, it would be beneficial to determine the point upriver where fall chum salmon stocks bound for the Tanana River system and the upper Yukon drainage above the mouth of the Tanana River become spatially separated. A tag and recovery program could demonstrate, for example, that Tanana River stocks become spatially separated at a particular location downriver from its mouth. Separate management of as many discrete spawning stocks as possible is the goal of this program.

Coho salmon are of minor importance compared to the more abundant fall chums. The 1974 commercial harvest of coho was only 16,825 fish. Early closures of the fall chum fishery in 1974 and 1976 resulted in reduced coho commercial harvests. Information obtained from a tag and recovery project for fall chum salmon would be applicable to coho since both species exhibit similar run timing and spawn in the same general areas.

As part of a statewide stock separation study, funds became available July 1, 1976 to conduct a 3 year tag-recovery program on Yukon River

fall chum salmon with the following objectives:

1. Determine the timing of separate stocks through the fishery.

2. Determine the pathways of movement of separate stocks through the fishery.

3. Determine the relative contribution of major spawning stocks to the fishery.

4. Estimate population size of the major stocks.

The first year of the tagging project was considered experimental with emphasis placed on the development of suitable methods for capture, tagging, and tag recovery.

Materials and Methods

The Galena area was chosen as the location for the tagging site (Figure 12). Information gained from the Galena tagging project would be applicable toward management of the lower River fall chum salmon fishery. The advantages of tagging at an upriver location are:

1. Fishwheels can be used as capture gear instead of gill nets, thereby greatly reducing mortality due to capture and handling.

2. The large number of fishery recoveries in the lower Yukon River that would result from tagging in the delta area would be eliminated. Recoveries in the lower River would not provide information on stock separation since spawning areas are located several hundred miles upstream.

Advantages of fishwheels as capture gear include: (1) fishwheels catch salmon which may be held in a livebox in good condition for tagging, (2) a fishwheel can be fished daily throughout the run to sample stocks in proportion to their passage rate in the area on a day-to-day basis giving a naturally weighed tag distribution, and (3) suitable fishwheel fishing sites had been located and fished previously by local fishermen.

Tagging was conducted on both north and south banks of the River and two fishwheels were rented on a contract basis from Galena area fishermen. Fishwheels rented in 1976 were of the standard large Yukon design (Plate 2). The north bank wheel incorporated a three "bag" system and could fish in about 15 feet of water; the south bank wheel was of the two

Figure 12. Fall Yukon tagging and recovery areas, 1976.

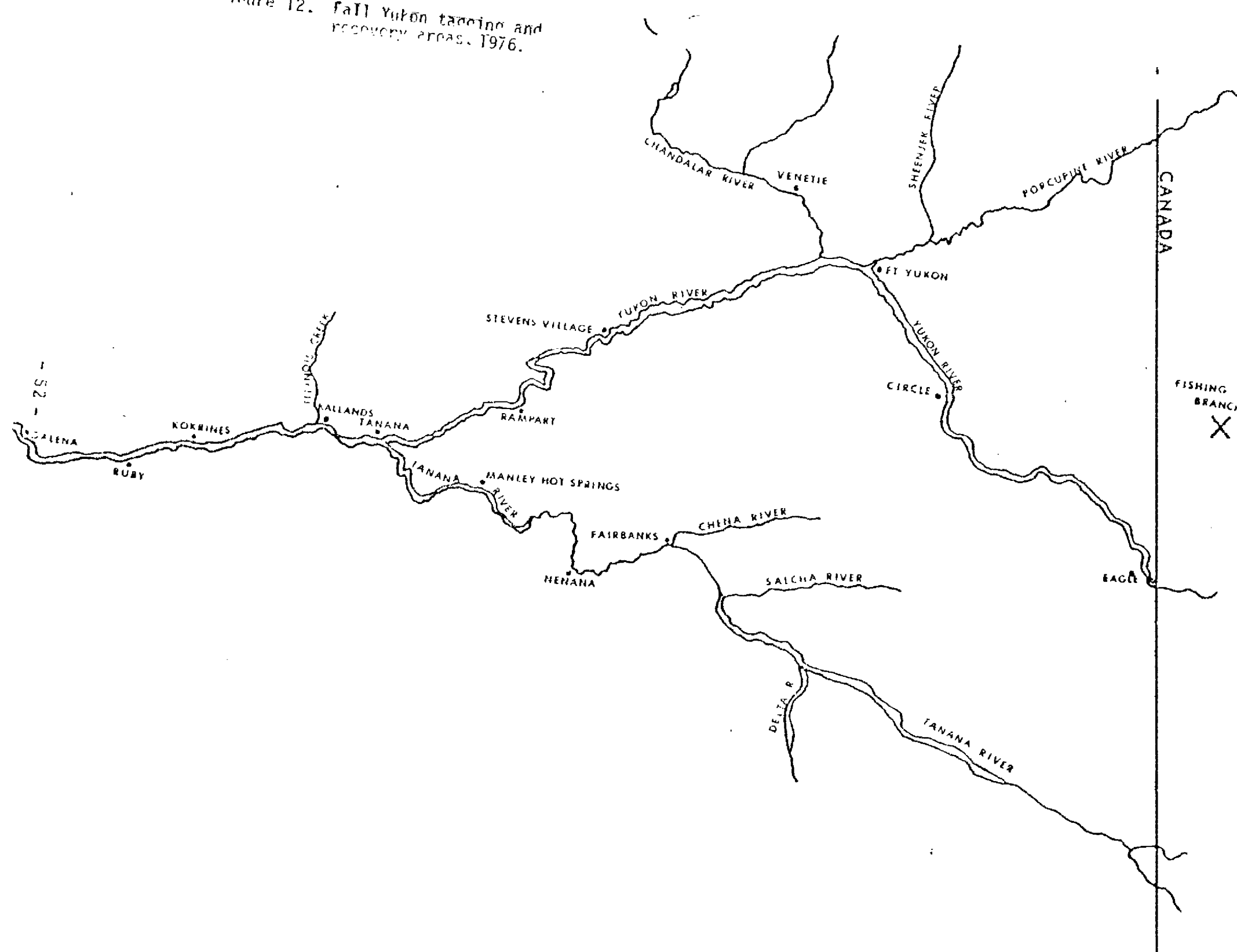
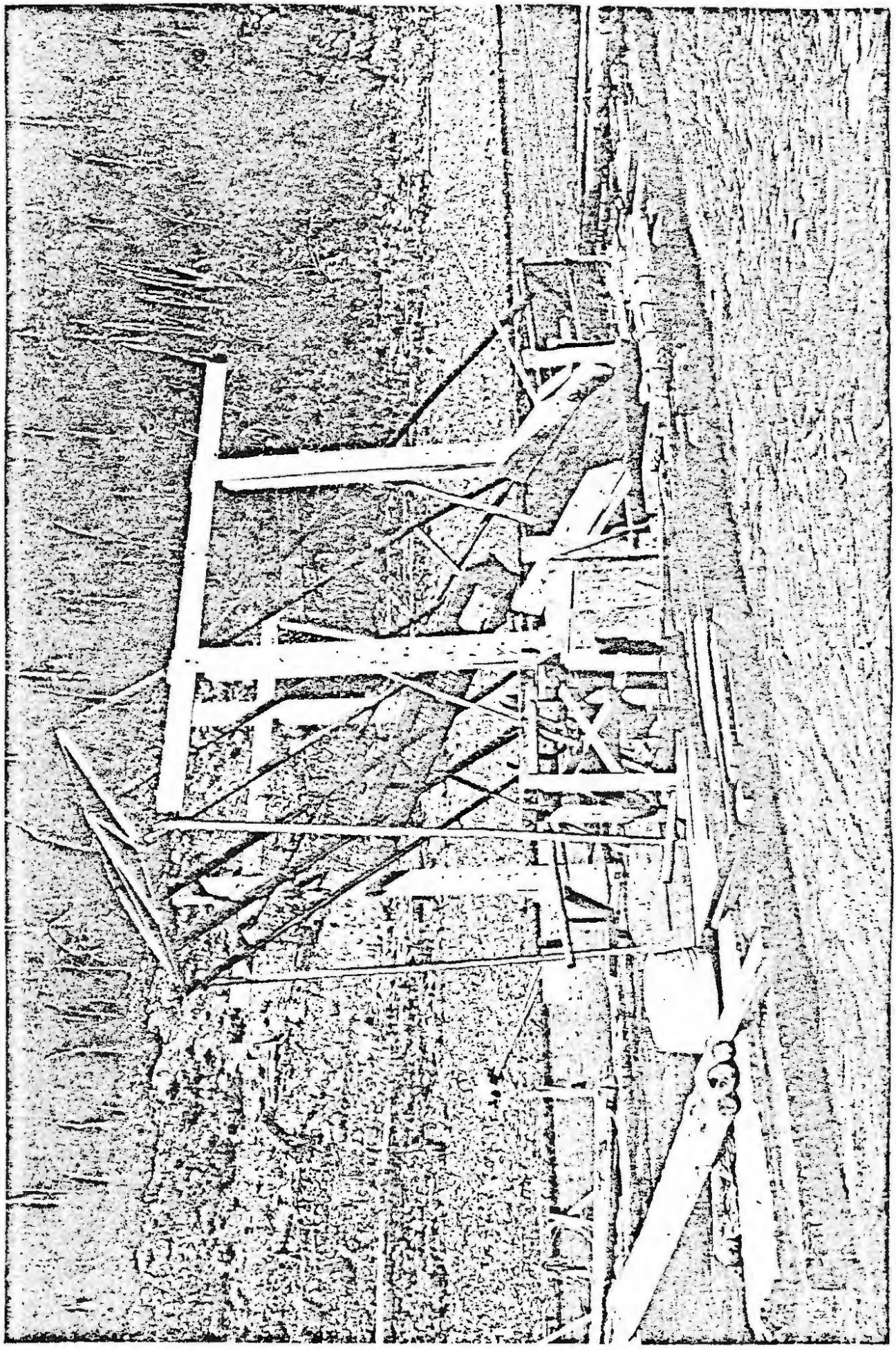


Plate 2. Galena fall tagging north bank fishwheel.



"bagger" type. Both wheels had leads out from shore to funnel salmon into the wheel.

Fishwheel number one was fished along the north bank upstream from Galena (River mile 555). Fishwheel number two was fished along the south bank upstream from Galena (River mile 540). Tagging was initiated at the north bank wheel August 12, and at the south bank wheel August 14. Tagging was terminated at the north bank site September 14 and the south bank site September 17. To allow ready field separation as to tagging location, north bank tagging was done with odd-numbered tags, south bank tagging was done with even-numbered tags, with a few exceptions.

Commercial fishermen utilizing fishwheels generally assume that most chum salmon migrate along the banks of the river during migration. This has been generally confirmed during observations of migration behavior in clearwater tributary streams. There is evidence, however, that some fish may follow sandbars in midstream during their migration up the Yukon River. If a fishwheel is fishing effectively, the basket turns immediately above the streambed. Fluctuations in water level require fishwheel adjustment. Comparisons of catch per unit effort between fishwheels at various locations or of various types to give an indication of run abundance may therefore be very imprecise. Catch is very much dependent on site location and the number and proximity of other fishwheels immediately downstream. This latter is probably a major factor in the Galena area where most productive sites are heavily fished. Two other wheels were run throughout most of the 1976 run within 200 yards downstream of the wheel at the south bank tagging site.

Base camps were established within the immediate vicinity of each fishwheel. The south bank wheel was reachable by way of a walkway from the bank. Communication was maintained between camps by radio. As the season progressed, daily fishwheel catches were used by management personnel as an index to run strength to assist in making decisions regarding fishing season openings upriver. Communication of catches to headquarters was accomplished by either ham radio or telephone from Galena.

According to the contract agreements issued, each tagged salmon was purchased from the fishwheel operator at the current market price; an additional $10.00 a day was paid for boat usage. The experienced Fish and Game crew was able to keep the wheels running with little problem in the absence of the operator. Detailed tagging procedures are listed in Appendix Table 27. Numbers of other fish species in fishwheel catches were recorded by date of capture.

Rewards of $2.00 were offered for each returned tag. Posters publicizing the tagging program were mailed to upriver villages (stores and

post offices). News notices were sent out to be circulated in the villages. Fishermen were requested to supply date of recovery, river location, bank of recovery, and fishing method. The reward check, along with information concerning the returned tag(s), was mailed to those returning tag(s).

Frequent visits were made to villages to personally contact fishermen and processors for tags recovered. Recoveries in the Yukon Territory were to be collected by personnel from the Whitehorse office of Environment Canada-Fisheries Service.

Tag recovery efforts were initiated in the Sheenjek, Toklat, and Fishing Branch rivers (Figure 13). Transportation to the Toklat and Sheenjek were by fixed-wing aircraft. The Fishing Branch River was accessible only by helicopter. Rubber rafts were utilized by recovery crews for transportation within the Fishing Branch and Sheenjek rivers. Tags were recovered from carcasses or from spawning fish retrieved by means of spear or shotgun. The upper Tanana River spawning areas were canvassed for tags by observers on foot. Spawning ground observations included:

1. The ratio of tagged to untagged fish.

2. Tag recoveries by date.

3. Air and water conditions and temperatures.

Carcasses and living fish were sampled in the Sheenjek, Toklat, and Delta areas throughout the period of on-site investigations. Data taken included sex and length (mid-eye to fork of tail). Scale and electrophoretic tissue samples were taken for later analysis.

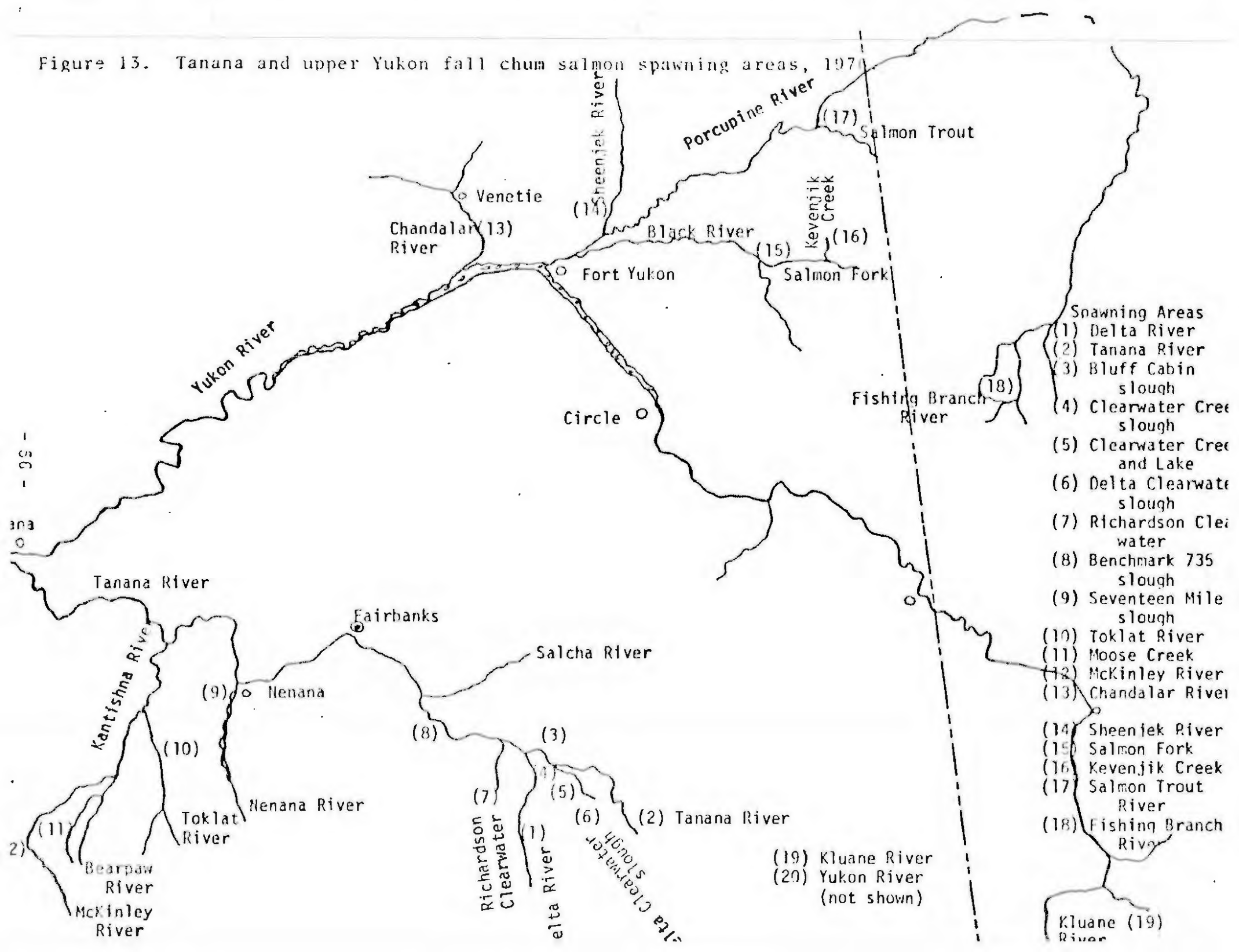
Basic keypunching, programming, and analysis of the 1976 data has been accomplished. In addition, data from earlier studies conducted in 1972 and 1973, but not as yet analyzed, has been programmed. A summary of earlier Yukon tagging projects is presented in Appendix Table 28.

Results and Discussion

One thousand two hundred and seventeen chum salmon and 14 coho were tagged. Five hundred forty-five (45%) were tagged along the north bank and 672 (55%) along the south bank.

According to the observations of Galena area fishermen, the north bank fall run as indicated by catch generally begins and peaks first followed by a later surge in south bank catches. This pattern was verified in the

Figure 13. Tanana and upper Yukon fall chum salmon spawning areas, 197



1976 tagging effort (see Figure 14 and Appendix Table 29). Galena fishermen also believe that the highest catch per fishwheel for the season occurs at south bank sites; this held true for the 1976 tagging. The "high daily number" tagged by the north bank site was 54 on August 30; the "high daily number" tagged by the south bank site was 61 on September 1. Ninety percent of the chums had been tagged by September 2 and September 6 for the north and south banks, respectively. Fifty-six percent of the tagged chums were male and 44% were female.

Five hundred seventy-four or 47% of chum salmon and 6 or 42% of coho salmon tagged have been recovered to date (Table 17). Percentage recovery by sex was similar to percentage tagged 57% and 43% male and female, respectively. Chi Square analysis of observed versus expected numbers of recoveries by sex (weighed by numbers tagged by sex) shows there to be no real difference (Appendix Table 30).

One hundred ninety-eight north bank tagged chum were recovered by the upper Yukon fishery; the south bank tagged chum recovery was 337. The number of south bank recoveries weighed by numbers tagged was significantly higher than would be expected (Appendix Table 30). Most of the Ruby area commercial fishery (some 30 miles upstream from the tagging sites) is along the south bank, and probably accounts for the discrepancy in numbers of tags recovered by bank or tagging.

The commercial fishery accounted for 66% of tagged chum recovered, the subsistence fishery 28%, spawning grounds 5% (Appendix Table 31). All but three of the spawning grounds recoveries were made by Fish and Game survey crews.

The fishwheel, heavily used in upper Yukon fisheries, accounted for 59% of chum recovered. Gillnet gear took 28% of tagged salmon recovered (Table 17).

Tag recoveries are listed by date of tagging in Appendix Table 32 with major areas of recovery given. Appendix Tables 33 and 34 and Figure 15 summarize tag recoveries by major recovery areas. Twelve percent of the recoveries were made by the local Galena fishery. The Ruby area fishery, which is the first major fishery upstream of the tagging sites, accounted for 26% of all tag returns. Forty-four percent of the chum salmon recovered in the Yukon River below the mouth of Tanana were tagged along the north bank and 56% were tagged along the south bank. This follows closely the percentage actually tagged by bank.

It is interesting to note that 27 (5% of total) recoveries were made from the Toklat River spawning grounds. Surveying effort on the Toklat was

Table 17. Recoveries of fall chum by gear, tagging location, and fishery activity, 1976.

	Gear				
	Fish Wheel	Gillnet	Stream Survey	Unknown	Total
No. Recov	340	160	29	45	574
%	59.2	27.9	5.1	7.8	100

Fishery Activity

North Bank

Comm	Subsistence	Stream Survey	Unknown	Subtotal
139	78	1	7	225

South Bank

Comm	Subsistence	Stream Survey	Unknown	Subtotal
230	76	25	5	336
369	154	26	12	561
65.8	27.5	4.6	2.1	100

Figure 14. Numbers of fall chum salmon tagged by bank of tagging, Galena 1976.

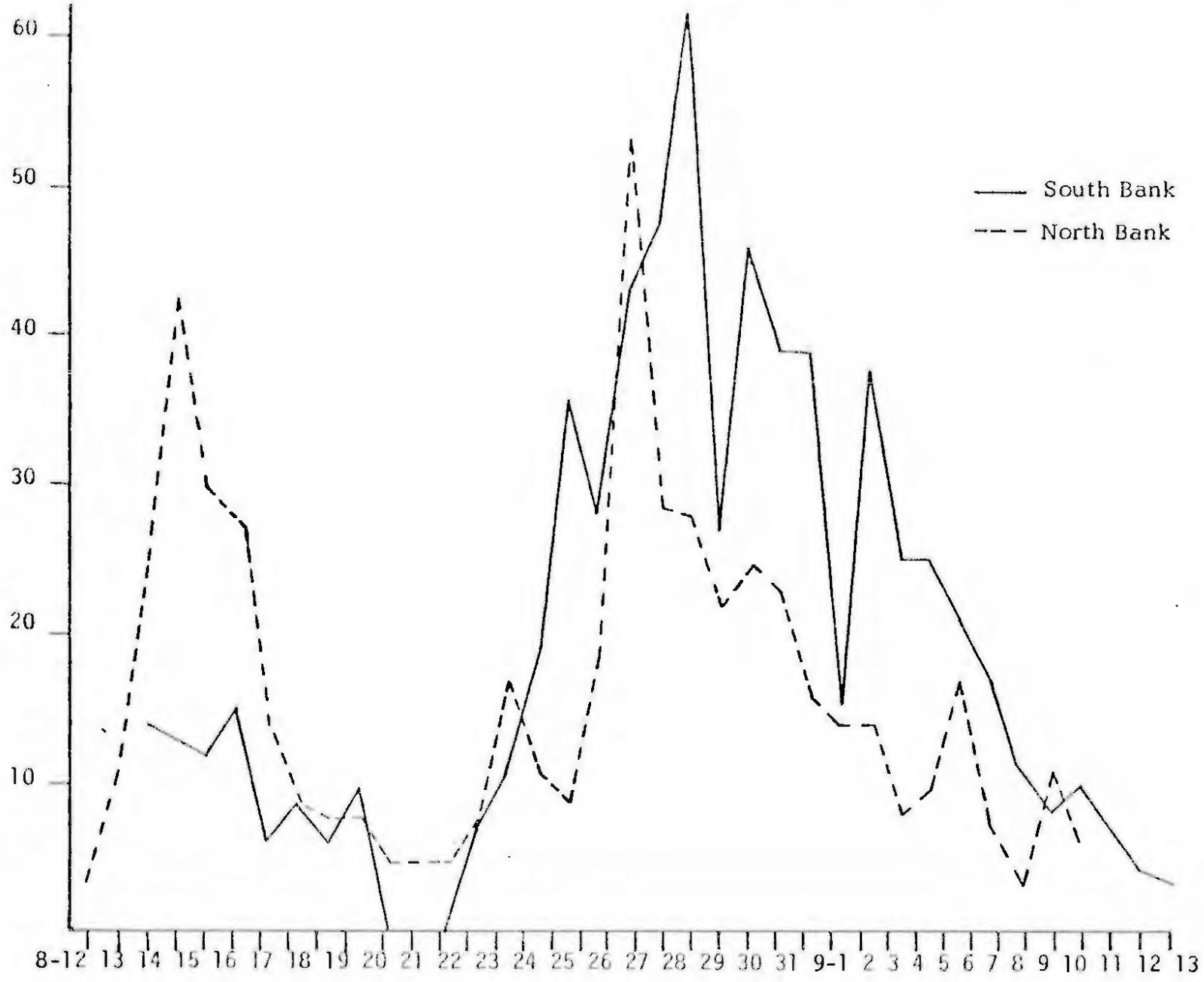
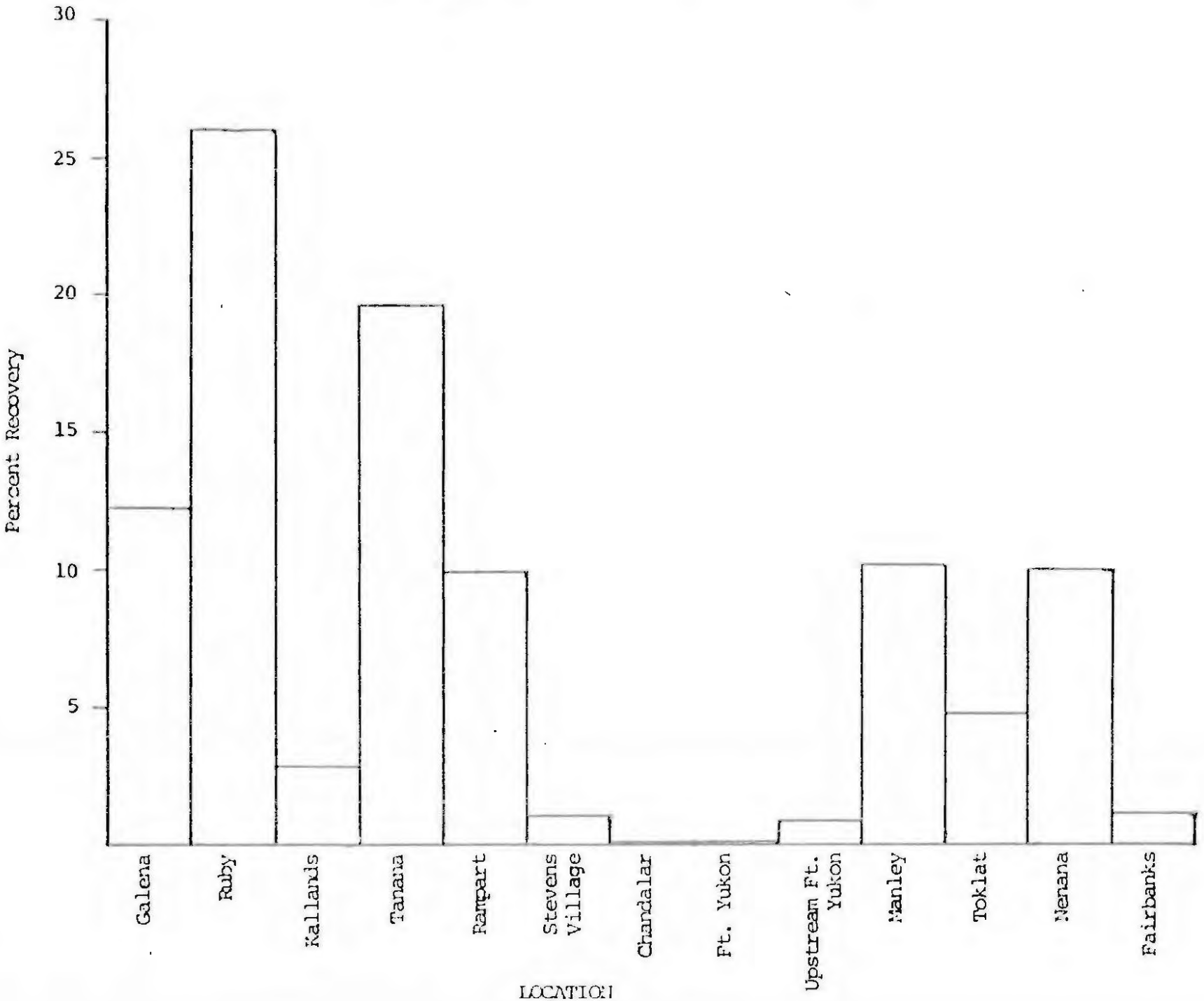


Figure 15. Percent of total Yukon chum salmon tag recoveries by area, 1976.



within the period of October 12 and 21. An estimated 6 to 12 thousand chum were observed from the ground in spawning areas covered on foot (roughly from 3 miles above to 3 miles below Knights Roadhouse). Die-off of spawning chums was estimated at 30-60% during surveys. Tags were recovered at the rate of 1 to every 250 to 500 salmon seen. This area proved to be ideal for covering by foot and raft surveys. Much of the major spawning area was clear water tributary streams or side channels. Tag spotting, recovery, and spawner density estimation proved difficult for main channel spawning areas where water was rendered turbid by glacial runoff.

Recoveries from the other major spawning grounds were disappointingly few. Considerable logistical problems were encountered on the Sheenjek River. Spawning areas were up to 30 miles apart, dieoff of spawners was late, freezeup preceded a good portion of dieoff making raft transportation to these areas impossible, and bears and other predators were observed to pick up carcasses almost as quickly as they died making few available for examination. Most Sheenjek spawning is in deep pool, spring type areas making observation of spawning salmon difficult. During the 1976 study, conducted between September 22 and October 19, operations were basically centered in Russell's cabin area. No tagged salmon were seen or recovered though an estimated 3,000 to 6,000 salmon were observed from the ground.

The lack of tag recoveries from Sheenjek spawning grounds may also be attributed to: (1) Failure to initially tag stock due to different pathways of upstream migration, and (2) heavy fishing mortality in the lower River could have removed most of the tagged stock - particularly true with small numbers of salmon tagged.

Initial transportation to the Fishing Branch was possible only by helicopter due to its remoteness and lack of possible fixed wing landing sites. Once on-site, the stream proved to be comparatively easy to cover by raft. Much of the spawning is in deep pools or spring areas making tag spotting and recovery difficult. Only two tagged salmon were observed and both were recovered. Fishing Branch observations were made between October 3 and 13 when an estimated 8,500 and 9,000 chums were observed by the crew. Only 10% die-off was estimated to have occurred by survey termination.

A single tag was recovered on Delta River surveys where an estimated 6,000 chum spawned. Most spawning was in shallow, clear water channels. Almost all carcasses were examined by Fish and Game crews or retrieved by subsistence fishermen following dieoff.

From the above discussion it seems apparent that the stocks of chum salmon tagged in the fall of 1976 were not tagged in proportion to their actual numbers; the Toklat chums were tagged at a high rate and Sheenjek chums were tagged lightly or not at all. On the basis of 1976 catch data, knowledge of local fishermen, and timing of spawning grounds die-off, tagging is believed to have been conducted through the period of maximum fall chum migration past Galena. It is therefore likely that movement of fall chums up the Yukon (at least during the 1976 season) follows distinctive, separate spatial pathways.

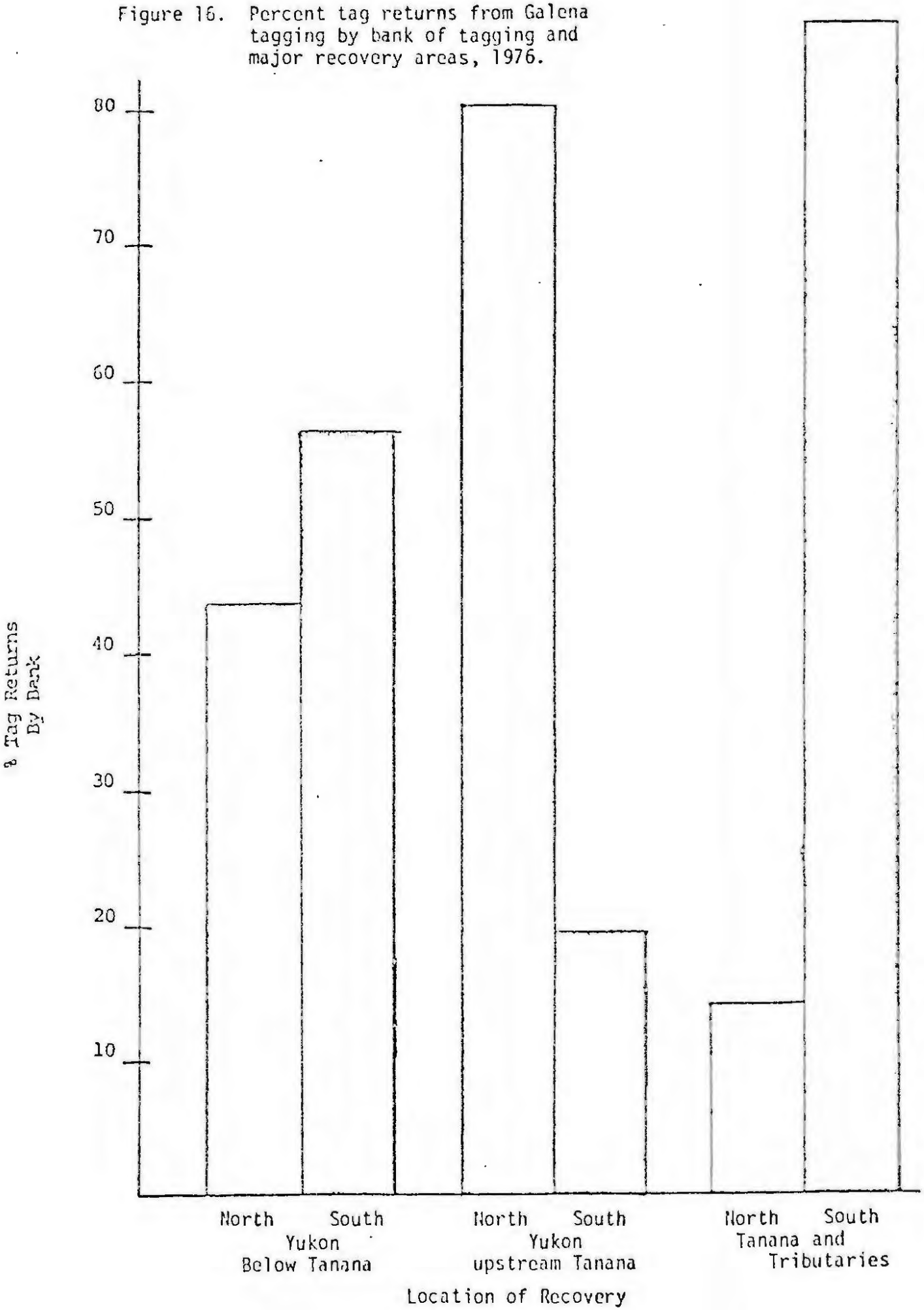
On the basis of the 1976 tagging there would appear to be a definite separation of salmon stocks by bank in the Galena area in respect to spawning destination (Figure 16). Eighty-one percent of the tagged salmon recovered in the upper Yukon above the Tanana were of north bank origin. Eighty-seven percent of tagged salmon recovered in the Tanana were tagged along the south bank. Twenty-six of the 28 tag recoveries from the Toklat spawning grounds were tagged on the south bank. The single Delta River tag recovered was of south bank origin. Of two tags recovered from the Fishing Branch, one was of south bank and one of north bank origin. The single tag recovered in the Chandalar was of north bank origin.

Tag recoveries gave some evidence of different cross-over patterns of Yukon chums from between Galena and Tanana. The highest cross over rate was found in the Galena area. The Galena fishery is largely north bank and 90% of the 69 tags recovered at this location were recovered along the north bank. Twenty-five or 40% of north bank recoveries were tagged on the south bank. The Ruby fishery is largely south bank and 87% of the 147 tags recovered were taken from the south bank. Nineteen or 16% of the south bank recoveries were of north bank origin. In the fishing areas near the village of Tanana a total of 110 tags were recovered; 66% were of north bank origin. At this location 14 or 18% of north bank recoveries were of south bank origin.

The general conclusion can be drawn from 1976 tag returns that chum salmon from Galena upstream seemed to be oriented to either the north or south bank of the Yukon. Tanana River or southern spawning fish seem to have been strongly south bank oriented; upper Yukon-Porcupine spawning fish seem to have been strongly north bank oriented.

On the average, chums tagged (155 fish) at the north bank site were recovered after 11.1 days and had covered 182.2 miles averaging 16.5 miles per day. Chums tagged (231 fish) at the south bank site were recovered after an average of 19.0 days and had covered an average of 168.2 miles for an average speed of 8.9 miles per day. For all recoveries (386 chum) the average time out was 15.8 days and average distance migrated

Figure 16. Percent tag returns from Galena tagging by bank of tagging and major recovery areas, 1976.



was 173.8 miles for an average of 11.0 miles/day. Chum recoveries below Galena or with incomplete data were omitted from this analysis. Trasky found a migration rate of 21.1 mi/day (Appendix Table 28).

Figure 17 gives the number of tag recoveries by date for the upper Yukon and Tanana recovery areas (fish tagged at both north and south banks included here). From this data is would appear that the majority of chums passing Galena before 8-28 were upper Yukon stocks. Toklat chum were the last stock to show up at the Galena site initially appearing on August 31.

Evidence of distinct stock pathways in the Galena area is found in comparative size data (Figure 18). Chum salmon tagged at the Galena north bank site average 581 mm. Sheenjek River fall chums average 601 mm. Chum salmon tagged at the Galena south bank site averaged 547 mm; Toklat fall chum salmon averaged 537 mm. The difference in average lengths of Toklat and Sheenjek River chums was significant at the 10% level (Appendix Table 25).

The age composition of Toklat and Sheenjek River fall chum escapements for 1976 as indicated by spawning ground samples is found in Figure 19. The larger Sheenjek chums were of older age representation - 42% age 4_1 and 53% age 5_1; the smaller Toklat chums were of younger age classes - 52% age 4_1 and 42% age 3_1.

Female comprised 64% and 73% respectively of the Sheenjek and Toklat escapement samples (Appendix Table 35). Males were predominant at the Delta River spawning areas (62%).

No significant difference was found in the average length of Sheenjek River chums sampled in 1975 and 1976. Sheenjek fall chums at 562 mm averaged smaller in 1974 than in 1976. Toklat sampling was not conducted in 1975, but 1974 chums sampled were significantly larger than 1976 chums sampled (562 mm vs 537 mm).

A population estimate of the 1976 fall chum run above Galena is possible based on tag return data and harvest data - (Appendix Tables 36 and 37). The total calculated population using a simple marked recovery estimation is approximately 164,700 salmon (95% confidence coefficient; low - 155,500; high 174,000). It is interesting to note that the sum of total harvest and total observed escapement at 150,400 very closely approach this figure (total harvest 72,400; observed escapement 78,000). If this population figure is accurate, only some 14,000 fall chums were undocumented as to utilization or spawning location. The rate of known exploitation of fall chums in the upper Yukon would be 44% (72,000/165,000 on the basis of this population projection). The total Yukon harvest rate of fall chums in 1976

Figure 17. Tanana and upper Yukon tag recoveries by date of tagging.

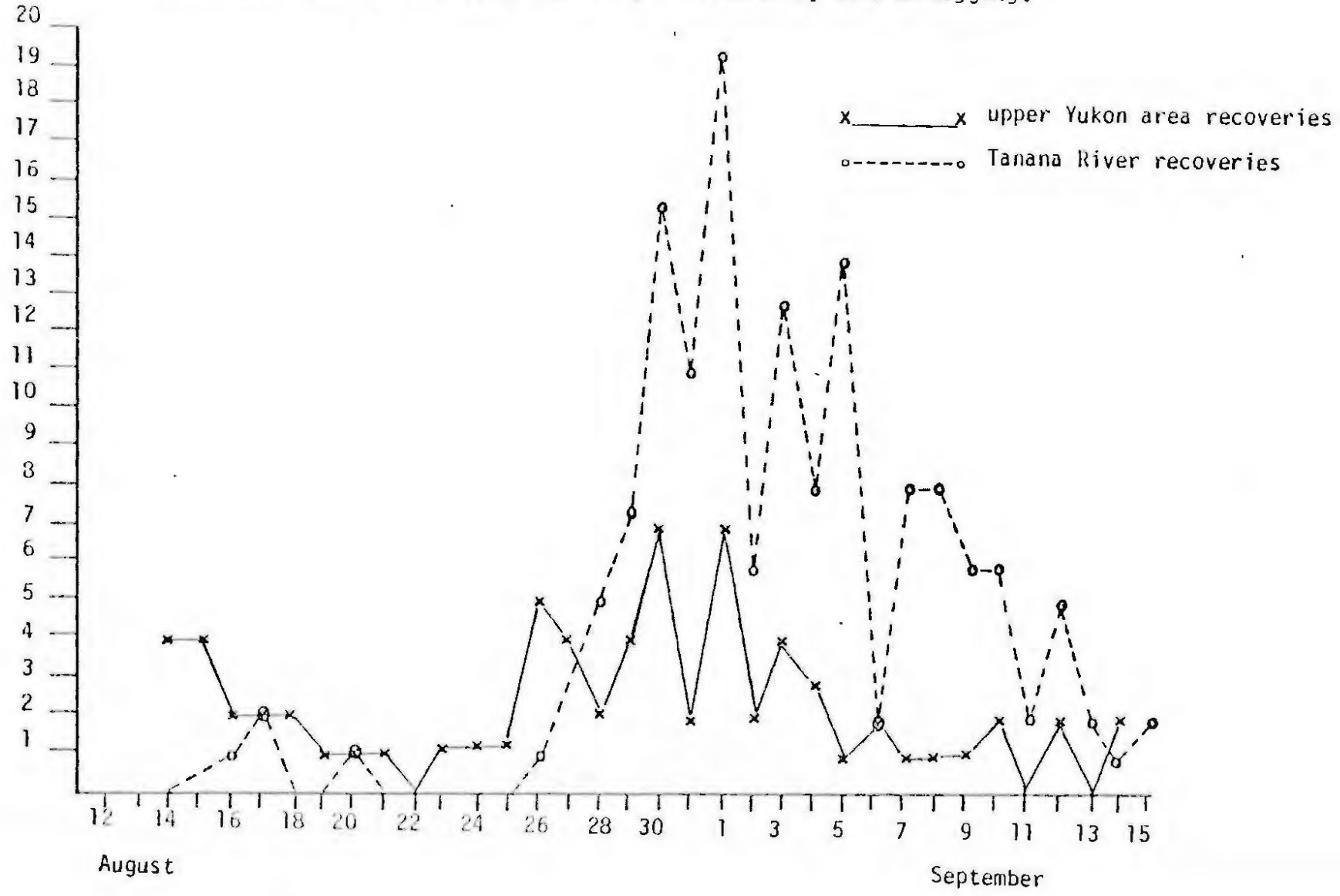


Figure 18. Comparative lengths of Yukon fall chum salmon populations.

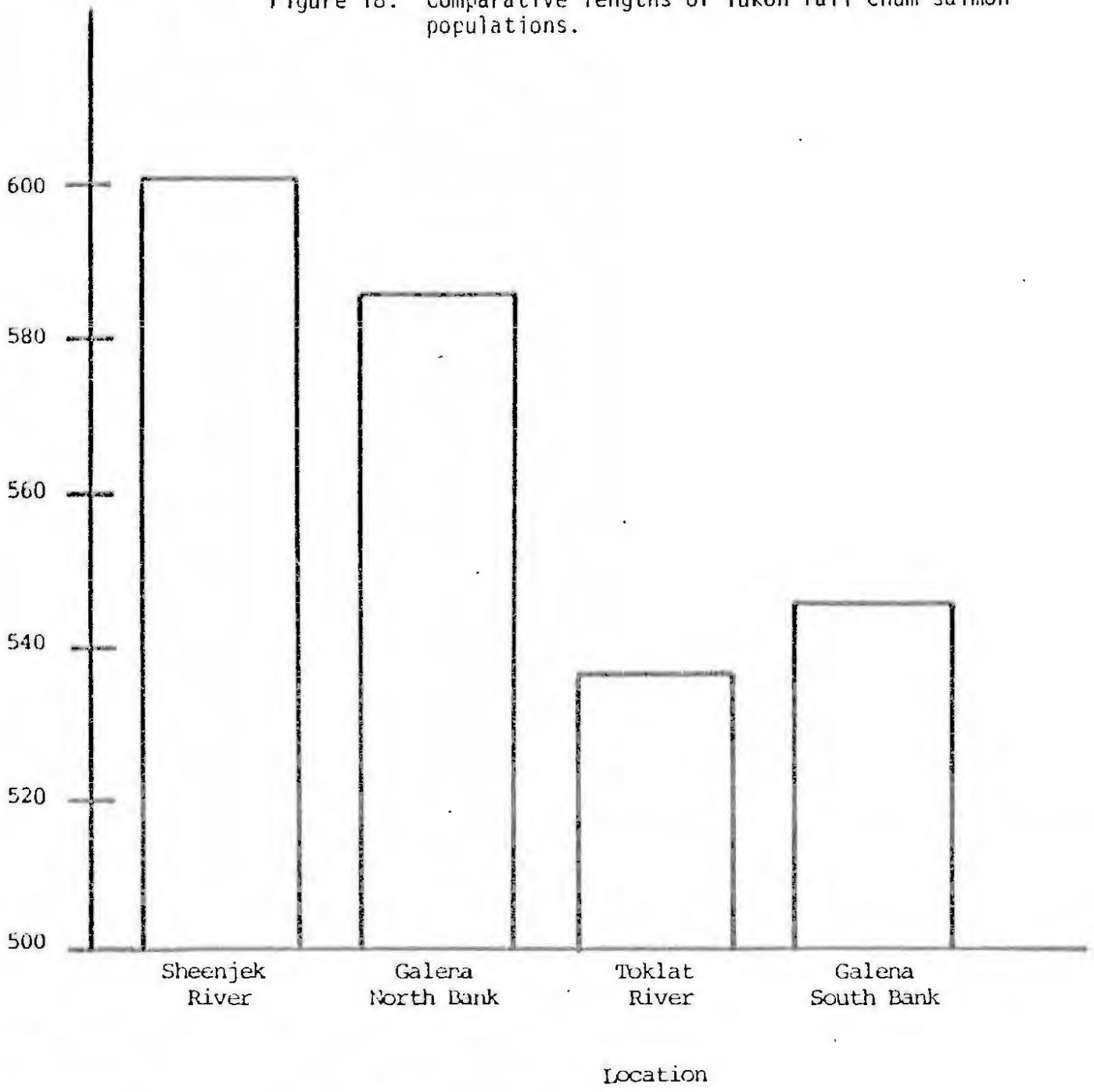
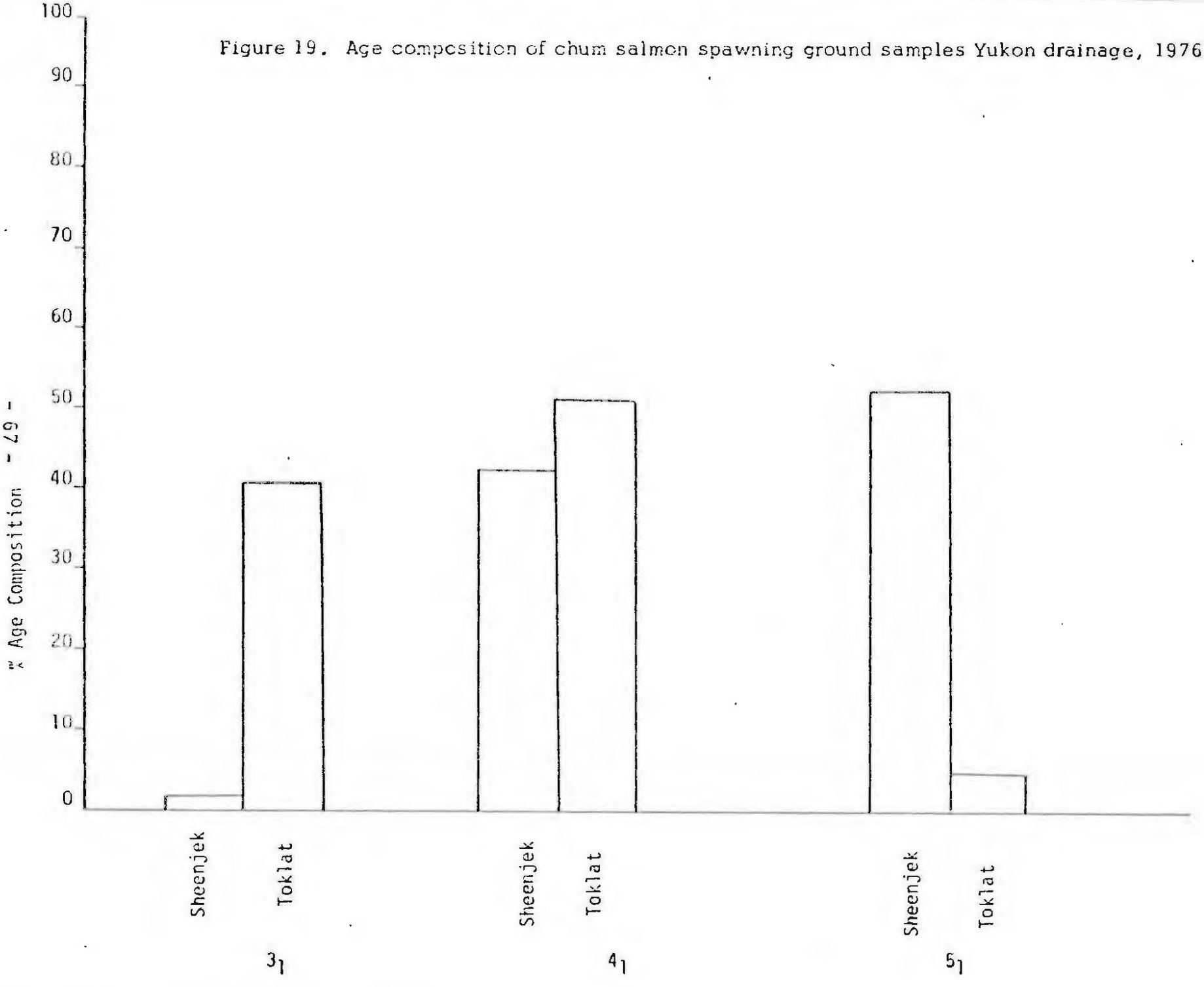


Figure 19. Age composition of chum salmon spawning ground samples Yukon drainage, 1976.



based on a lower Yukon catch of 166,282, upper Yukon utilization of 72,412, and upper Yukon population of 165,000 would approach 72.2% (238,000/331,000).

No results are available from the electrophorectic analysis studies at this time. Preliminary analysis of scale characteristics gives definite promise that separation and identification of Toklat and Sheenjek stocks will be possible.

Summary

Fishwheels were used to tag a total of 1,224 fall chums and 14 coho in 1976. Fishwheel number one was fished upstream of Galena along the north bank of the Yukon at River mile 555. Fishwheel number two was fished upstream of Galena along the south bank of the Yukon at River mile 540. Tagging was initiated at the north wheel site on August 12 and at the south wheel site on August 17.

Tagging peaked at the north bank site on July 30 and at the south bank site on August 1. Of total chums tagged, 44.8 and 55.2% were of north and south bank origin, respectively.

To date a total of 574 or 47% of chum and 6 or 42% of coho salmon tagged have been recovered. No difference in the rate of recovery of male and female chums was seen. The number of south bank recoveries weighed by numbers of salmon tagged was significantly higher than it would be expected to be by chance alone.

The commercial fishery accounted for 66% of tagged chums recovered; the subsistence fishery took 28% of tagged chum recovered. A total of 5% of the recoveries were from the major spawning grounds. The fishwheel was the major recovery gear accounting for 59% of tags recovered followed by gillnets at 28%.

Twelve percent of total recoveries were by the local Galena fishery. The Ruby fishery, accounted for 26% of all tag returns. Other important fisheries are listed by order of ranking in numbers of tag returns: Tanana Village 20%, Rampart 10%, Manley 10% and Nenana 10%.

Inherent weakness in the above calculations would include: the failure to tag all segments of the population equally; and the unequal exploitation of some population segments by the fisheries.

By tagging only salmon in a good condition, mortality should have been held to a minimum, but unknown figure. Tag shedding has been found to be a serious problem in some tagging studies. Utilization of the Petersen

disc tag should have held shedding to a minimum level. In studies involving gillnets as the primary recovery gear, Petersen disc tagged fish may be snagged and recovered at a disproportionally high rate in comparison to untagged fish. The loss of a number of tagged fish from the pool of recoverable salmon would tend to increase calculated population size.

In the early phases of the 1976 tagging a small number of summer chums may have been tagged. The separation of summer and fall stocks this far up the Yukon may be very difficult to impossible in border-line cases.

Sears (1964) estimated the fall chum population above Rampart to be 131,000. The best index available to total fall chum abundance in the Yukon system for 1974 and 1975 combines observed escapement, commercial, and subsistence harvests and was respectively 492 and 971 thousand (Mauney 1976).

A listing of other fish species taken during fishwheel tagging operation is given in Appendix Table 38. Whitefish species were predominant in numbers with humpback whitefish comprising up to 30% of catches. Whitefish are utilized by local subsistence fishermen.

On the basis of the 1976 tagging there would appear to be a definite separation of chum salmon stocks by bank in respect to spawning destination in the Galena area. Eighty-one percent of the tagged chum recovered in the upper Yukon above the Tanana, were of north bank origin. Eighty-seven percent of tagged chums recovered in the Tanana system were of south bank origin.

Chum salmon tagged at the north bank site were of a significantly greater average length than chums tagged at the south bank site. Sheenjek River spawning ground chums sampled were older, comprising 53% 5_1 age fish and of a greater length than the Toklat fish which were comprised of 42% age 3_1 and 52% age 4_1 classes.

A simple population estimation of 164,700 fall chums was made for the upper Yukon based on the 1976 tagging and harvest. A high rate of fall chum utilization of 44% by the upstream fisheries was indicated. An exploitation rate of 72% of the entire Yukon River fall chum salmon run was indicated for 1976 (lower Yukon harvest included).

The lack of tag recoveries from Sheenjek spawning grounds could be attributed to a number of factors: (1) failure to initially tag the stock due to different migration pathways such as along midriver sandbars, (2)

heavy fishing mortality downstream in the main River could remove most of the tagged stock - especially since small numbers of salmon were tagged, (3) failure to spot tagged salmon in the stream due to deep water and logistical problems in canvassing the stream, and (4) predation of tagged fish before recovery.

Recommendations

A minimum of 3,000-4,000 fall chums should be tagged during the 1977 field season to increase spawning ground recoveries. The outlook for the 1977 return of fall chum to the Yukon, based on brood year escapement, is poor. The 1973 brood year for the Fishing Branch River, which would give rise to the age 4_1 return in 1977, was a historically low return of 15,989 (fish weir count). The 1973 observed Toklat River escapement was approximately 6,000.

More productive fishing locations should be found than those fished in 1976. Indications are that the catch per unit effort in Ruby is much higher than in the Galena area. Preliminary interviews show fishwheels to be available in this area for charter on both banks.

Tagging in a new area would also permit determination as to whether stocks are separated in time.

It is recommended that recovery efforts in the Fishing Branch River be initiated approximately a week later than in 1976 - preferably October 10-20. The timing of recovery efforts in the Toklat River were satisfactory in 1976, October 12 through October 21.

No ready solution is apparent for enhancing Sheenjek recoveries. The 1976 efforts were initiated earlier than necessary. Probably the most feasible program to follow would be the utilization of aircraft based in Ft. Yukon. Major spawning areas could be canvassed by landing on gravel bars. The aircraft would be either held or crews could stay overnight before pickup and moving to a new site the next day. Rafting following dieoff is not practical in the Sheenjek River. Sheenjek operations should take place between October 5 and 15. Another approach to the Sheenjek recovery program would be to weir the lower river and recover tagging fish as they move upstream.

During Fishing Branch and Sheenjek River operations in 1976, conflicts arose between grizzly bear and Department Zodiac rafts with the rafts being damaged. Rafts or tents should never be left at spawning ground sites unattended. Rafts may have to be hauled up into trees when not in

use on the Fishing Branch and Sheenjek rivers. It may prove to be effective to spray the rafts with some type of mace or canine repellent.

Remote recovery crews should be equipped with an emergency signal broadcast system.